

Status of Tern Colonies in the Honduras Bay Islands

DAVID T. SHOCH¹ AND DAVID L. ANDERSON²

¹Winrock International, 1621 North Kent Street, Suite 1200, Arlington, VA 22209

²Museum of Natural Science, Department of Biological Sciences,
119 Foster Hall, Louisiana State University, Baton Rouge, LA 70803

Abstract.—In the first comprehensive survey of tern colonies in the Honduras Bay Islands, 46 cays were surveyed in 2005 and 2006 and three species of terns were observed nesting in colonies on ten individual cays. Apparent colony turnover was high between years for Least (*Sternula antillarum*) and Roseate (*Sterna dougalli*) Terns, from 71% to 100%, respectively. The first nest records of Bridled Tern (*Onychoprion anaethetus*) for Honduras are documented. Received 10 October 2006, accepted 18 December 2006.

Key words.—Caribbean, Honduras Bay Islands, nesting, colonies, terns.

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The Honduras Bay Islands (henceforth Bay Islands) are a discrete group of islands in the Caribbean Sea off the coast of mainland Honduras. Despite wide recognition of the marine ecosystems of the Bay Islands (Harborne *et al.* 2001; Almada-Villela *et al.* 2002) and their conservation designation as part of the multinational Mesoamerican Reef, comparatively little is known about marine birds in the region. To date, information on seabirds has been derived from a handful of published notes (Udvardy *et al.* 1973; Seutin *et al.* 1997; Thorn and Medina 2005), and knowledge of these bird populations is incomplete and outdated.

Terns in particular are a significant component of the marine avifauna breeding in the Bay Islands, representing six of seven seabird species known or suspected to nest there (Shoch and Canfield 2006). Several of these species are of conservation importance, such as the regionally threatened Roseate Tern (*Sterna dougalli*) (USFWS 1993), and the Royal (*Thalasseus maxima*), Sandwich (*T. sandvicensis*) and Least (*Sternula antillarum*) terns, all at the southern limit of their known breeding distribution in Mesoamerica. To fill this gap in knowledge and to provide a base against which future observations can be evaluated, we conducted the first comprehensive survey of tern breeding colonies in the Bay Islands.

METHODS

Study Area

This study was conducted in the Bay Islands (15°94' to 16°54'N, 87°00' to 85°81'W), consisting of the main

islands and associated cays of Utila, Roatán, and Guanaja, and the Cayos Cochinos. Cays off Roatán are concentrated around the smaller island of Barbareta and are hereafter referred to as the Barbareta cays. These islands are on the continental shelf from 19 to 56 km off the coast of mainland Honduras (Fig. 1). The nearest neighboring islands, cays off Belize and Moskitia, and the Swan Islands, are approximately 110, 270 and 220 km distant, respectively, and thus the Bay Islands are a natural geographic unit.

We identified 46 cays from maps and satellite imagery, and surveyed these in 2005 and 2006, to produce a complete survey of cays in the Bay Islands (Table 1).

Field Observations

Field observations were carried out in 2005 from 12 to 28 August, between 06.00 and 15.00 h, and in 2006 from 11 July to 1 August, between 07.30 and 13.00 h. Weather conditions were uniform with clear skies and low to moderate winds.

At each cay surveyed, complete counts were made from the ground or by boat and verified independently by two or more observers. For a given cay, only birds observed in specific association with that cay (e.g., roosting, incubating, feeding dependent young, in transit to or from) were tallied. Birds were identified to species, and age classes were simplified to distinguish juveniles and adults (i.e., first and second summer individuals were not distinguished from adults). The juvenile age class was used to refer to fledged juveniles only. UTM coordinates were recorded at each cay surveyed using a global positioning system (GPS) unit.

Because all potential colony sites within each of the four principal island groups were surveyed in a single day, and the entire study area surveyed within a maximum period of three weeks (16 and 21 days for 2005 and 2006, respectively), surveys were designed to minimize risk of double counting.

Sites were considered to represent breeding colonies where one or more of the following was observed: territorial behavior (e.g., agonistic behavior toward the observers), courtship, incubating posture, eggs, or flightless young. The minimum number of adults at each colony was based on either a direct count or double the number of observed nests, whichever was greater. Annual colony turnover rates were calculated as per Erwin *et al.* (1981).

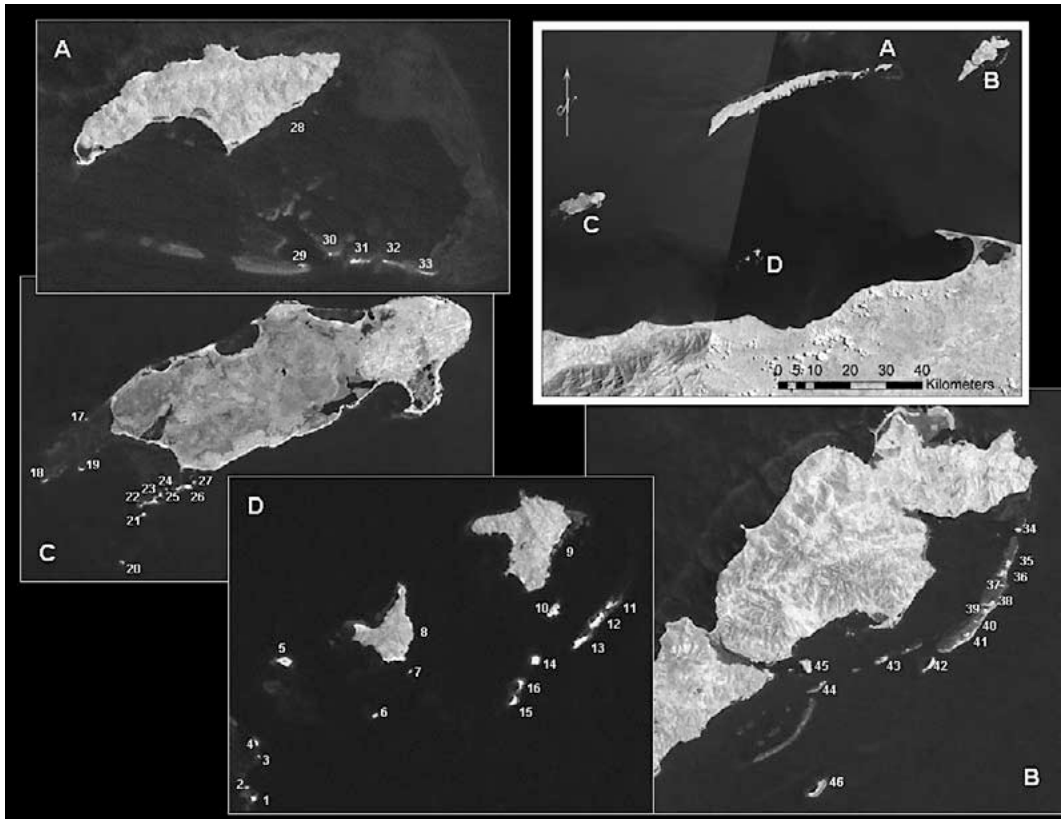


Figure 1. Main islands and associated cays of Honduras Bay Islands surveyed for breeding terns in 2005 and 2006. A. Barbareta cays, B. Guanaja cays, C. Utila cays, and D. Cayos Cochinos. Map no.: identity of cays in Table 1.

At each active colony, total nest and chick counts were obtained using complete perimeter counts, except in the case of the artificial cay in Utila, where counts were obtained via strip-transect sampling. At this site, following measurement of the dimensions of the nest area, sampling was conducted by delineating two 18 m \times 2 m transects systematically oriented along the long axis of the site (22% area sampled). No further ground sampling was carried out to minimize disturbance to the colony. Nests were tallied on observation of eggs, egg-shell fragments, and dead or live chicks.

RESULTS

We found ten active tern colonies in 2005 and 2006 (artificial cay, Raggedy Cay, Cayo Arena, Cayo Zacate, Cayo Gallo, Middle Cay, Falls Mahegeny, Busher Mahegeny, Kiatron's Cay, Clark Cay). Colonies were predominately on small, uninhabited cays (Table 1) with extensive areas of sand or coral cobble and no or sparse vegetation limited to herbaceous and low succulents (mostly *Sesuvium portulacastrum*, also *Ipomea* sp., *Euphorbia* sp.). Local

informants revealed that historic colonies included beaches on the main islands of Utila and Barbareta, and on Cayo Timón, Cayos Cochinos, all of which at the time of this investigation received frequent recreational use and appeared unoccupied by terns.

Of note was a colony of Roseate and Least terns discovered in 2005 on an artificial cay recently (ca. 2000) constructed on a reef off the southwest coast of Utila. The surface of the cay was built up to approximately one m above the waterline and enclosed by a concrete seawall, and featured a roughly rectangular area (23 m \times 14 m; 322 m²) of exposed sand with sparse low vegetation (*Sesuvium portulacastrum*, *Suriana maritima*, grasses, *Euphorbia* sp., *Ipomea* sp., one low *Casuarina*) in front of a vacant house. Density of Roseate and Least Tern nests at the site was estimated from sampling data as 0.19 and 0.03 nests per square meter, respectively.

Table 1. Main islands and associated cays of Honduras Bay Islands surveyed for breeding terns in 2005 and 2006. Map no.: geographical position in Figure 1.

Name	Map number	Dates surveyed/Active colonies		Human inhabited ^b
Cayos Cochinos		12 August 2005	24 July 2006	
Cayo Bolaños	1			X
Cayo Arena	2	X	X	
Cayo Zacate	3	X	X	
Cayo Timón	4			
Cayo Culebra	5			X
Cayo Paloma	6			
Cayo Gallo	7	X	X	
Cayo Cochino Menor	8			X
Cayo Cochino Mayor	9			X
Cayo Borrego	10			X
Cayo Balfate	11			X
Cayo Largo Arriba	12			X
Cayo Largo Abajo	13			X
Cayo Redondo	14			X
Cayo Chachahuat 1	15			X
Cayo Chachahuat 2	16			X
Utila		13 August 2005	11 July 2006	
Raggedy Cay	17	X	X	
Southwest Cay	18			X
Sandy Cay	19			X
“Artificial cay”	20	X		X
Little Cay	21			X
Morgan Cay	22			X
Water Cay	23			X
Bell’s Cay	24			X
Jack Neal Cay	25			X
Pigeon Cay	26			X
Diamond Cay	27			X
Barbareta		27-28 July 2005	15 July 2006	
Barbareta	28			X
Little Cay	29			
Middle Cay	30	X	X	
Pigeon Cay	31			
Falls Mahegeny ^a	32	X		
Busher Mahegeny	33		X	
Guanaja		18 August 2005	1 August 2006	
Northeast Cay	34			
Dr. Burn’s Cay	35			X
Hendrick’s Cay	36			X
Mr. Ben Cay	37			X
Josh’s Cay	38			X
Unnamed cay west of Josh’s Cay	39			
Clark’s Cay	40		X	X
Jack Cay	41			
Halfmoon Cay	42			X
Kiatron’s Cay	43		X	
Pond Cay	44			X
Elmar Reef	45			
Southwest Cay	46			

^a“Mahegeny” is a Bay Islander term referring to a small sandy islet.^bCay occupied by a house.

Survey results are summarized and presented by species.

Brown Noddy (*Anous stolidus*)

Observations of Brown Noddy were recorded in the Utila Cays and Cayos Cochinos (Table 2). No evidence of local breeding was observed. To date the species has not been documented breeding in Honduras (Monroe 1968; Bonta and Anderson 2002). Nearest known colonies of Brown Noddy have apparently disappeared in recent decades from Cancún, Mexico (Howell *et al.* 1990) and the Belize cays (Howell and Webb 1995; Jones 2003; H. Lee Jones, pers. comm.). The only previous published observation from the Bay Islands was of an immature Brown Noddy recorded by Udvardy *et al.* (1973) at Sandy Cay, Utila, on 28 June 1971.

Bridled Tern (*Onychoprion anaethetus*)

Bridled Tern colonies were found at the Utila Cays, Barbareta Cays, and Cayos Cochinos (Table 2). Colony turnover was comparatively low (annual rate = 0.20; N = 5). Courtship (15 July 2006) and incubating adults or eggs (11 and 24 July 2006) were observed. Nesting was confirmed in 2006 at Raggedy Cay, Cayo Zacate, and Cayo Gallo (Fig. 2), where birds behaved agonistically in 2005. Although only five nests were found in 2006, time spent searching for concealed nests was minimized to reduce disturbance to the colonies and consequently the actual number of nesting pairs present was likely greater.

Although nests with eggs have been noted as early as April in Belize (Jones 2003), because of the comparatively long incubation and fledgling periods of Bridled Tern, totaling some three months (Schreiber and Burger 2002), young birds should still be in evidence in July where egg laying took place in April, and therefore it is unlikely that Bridled Terns bred successfully earlier in the Bay Islands during the years of this investigation.

Of five active nests discovered, one was located under a low *Conocarpus erectus* shrub, two within rock crevices, and two in the open. In all cases eggs were placed on bare

substrate with no nest material added. Bridled Tern colonies tended to be encountered on sites of rockier coral cobble substrate and more uneven ground with denser vegetative cover than sites where Roseate and Least Tern nests were encountered. Adults were often found stationed on promontories such as rocks, driftwood, or oil drums near nest sites.

The Bridled Tern was documented for the first time in Honduras at Raggedy Cay in July 2004 (Thorn and Medina 2005). The observations and photographs from this study establish the first documented nest records of this species in Honduras. Small nesting colonies of Bridled Terns are known nearby from Cancún and Isla Cozumel, Mexico, and from cays off the coast of Belize (Howell *et al.* 1990; Jones 2003; H. L. Jones, pers. comm.), and their discovery in Honduras is not unexpected.

Least Tern

All of the principal island groups within the Bay Islands hosted nesting Least Terns in at least one of the two seasons investigated. Least Terns were found nesting at three cays in 2005 and at four cays in 2006, only one of which was occupied in both seasons (Table 2). Apparent colony turnover was high (annual rate = 0.71; N = 6). Incubating adults or eggs (13 August 2005; 15 and 24 July, 1 August 2006), downy young (13 August 2005, 1 August 2006), fledged juveniles (13 August 2005), and adults feeding juveniles (27-28 August 2005) were observed.

The survey of the Barbareta Cays in 2005 took place too late in the season to confirm nesting, however, adult and dependent juvenile Least Terns were still present and Orwil James, a local fisherman, reported nesting in July 2005 at Middle Cay and Fall's Mahegeny prior to the formal field work. In addition, in 2006 a minimum of 20 Least Terns were seen in Utila Harbor, some carrying fish in apparent transit to a nearby colony, although efforts to locate any tern colonies on Utila that year were unsuccessful.

Nesting in the Bay Islands had been documented before by Udvardy *et al.* (1973) at Sandy Cay, Utila, where 60 to 70 adults, 20 ju-

Table 2. Minimum numbers of adult and juvenile terns and nests observed in Honduras Bay Islands, 2005 to 2006.

Species	Island group	Adults	Nests ^a	Juveniles	Active colony sites
12 to 28 August 2005					
Brown noddy					
<i>Anous stolidus</i>	Utila	4		2	
	Total	4		2	
Bridled Tern					
<i>Onychoprion anaethetus</i>	Cayos Cochinos	24			Cayo Zacate, Cayo Gallo
	Utila	22			Raggedy Cay
	Total	46			
Least Tern					
<i>Sternula antillarum</i>	Utila	25	9 (2-18) ^b	4	Artificial cay
	Barbareta	65		6	Falls Mahegeny, Middle Cay
	Total	90	9	10	
Roseate Tern					
<i>Sterna dougalli</i>	Cayos Cochinos	103	8	20	Cayo Arena
	Utila	185	63 (27-98) ^b	14	Artificial cay
	Total	288	71	34	
Royal Tern					
<i>Thalasseus maxima</i>	Cayos Cochinos	13		1	
	Barbareta	2			
	Guanaja	10			
	Total	25		1	
Sandwich Tern					
<i>Thalasseus sandwicensis</i>	Cayos Cochinos	11			
	Barbareta	22		2	
	Total	33		2	
11 July to 1 August 2006					
Brown noddy					
<i>Anous stolidus</i>	Cayos Cochinos	1			
	Total	1			
Bridled Tern					
<i>Onychoprion anaethetus</i>	Cayos Cochinos	30	4		Cayo Arena, Cayo Zacate,
	Utila	22	1		Cayo Gallo
	Barbareta	9			Raggedy Cay
	Total	61	5		Busher Mahegeny
Least Tern					
<i>Sternula antillarum</i>	Cayos Cochinos	30	15		Cayo Gallo
	Barbareta	36	2		Middle Cay
	Guanaja	26	7		Kiatron's Cay, Clark Cay
	Total	92	24		
Roseate Tern					
<i>Sterna dougalli</i>	Cayos Cochinos	25	3		Cayo Gallo
	Barbareta	159	42		Busher Mahegeny
	Total	184	45		
Royal Tern					
<i>Thalasseus maxima</i>	Cayos Cochinos	23			
	Barbareta			1	
	Total	23		1	
Sandwich Tern					
<i>Thalasseus sandwicensis</i>	Cayos Cochinos	31			
	Barbareta	20		3	Busher Mahegeny
	Total	51		3	

^aNests identified by presence of eggs, downy young, or incubating adults.^bMean and range (mean \pm SE) (N = 2).

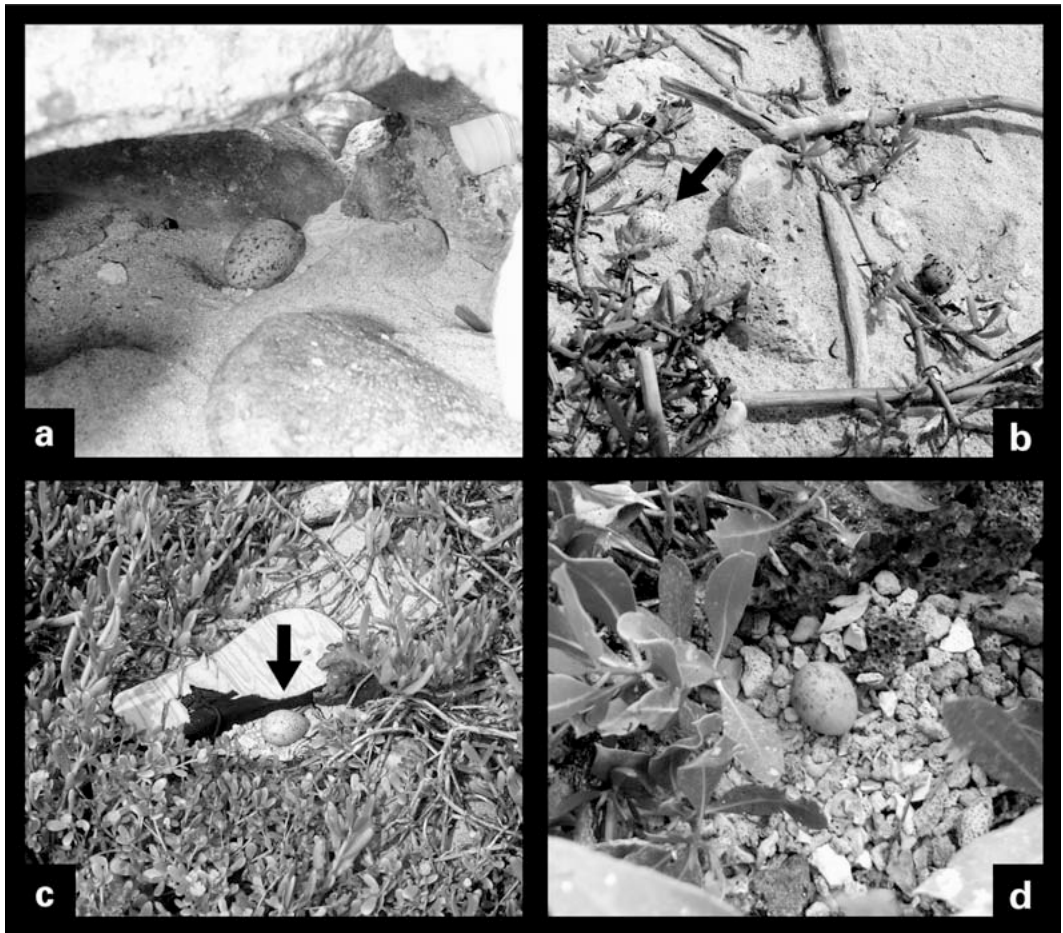


Figure 2. Bridled Tern (*Onychoprion anaethetus*) nests in the Honduras Bay Islands in 2006. a. Cayo Zacate, Cayos Cochinos, 24 July 2006; b. Cayo Gallo, Cayos Cochinos, 24 July 2006 (nest at right is of Roseate Tern (*Sterna dougallii*)); c. Cayo Zacate, Cayos Cochinos, 24 July 2006; and d. Raggedy Cay, Utila, 11 July 2006.

veniles, and 31 nests were reported between 19 June and 8 August 1971. Additionally, Urdardy *et al.* (1973) made reference of a report of a "colony of small terns near Little Hog Island [Cayo Cochino Menor]", likely referring to Least or Roseate terns.

Roseate Tern

Roseate Terns were found breeding in the Utila Cays, Barbareta Cays, and Cayos Cochinos (Table 2). None of the sites was consistently occupied for the two seasons under investigation, equivalent to an annual turnover rate of 1.0 ($N = 4$). Courtship (15 July 2006), incubating adults or eggs (13 August 2005, 15 and 24 July 2006), downy

young (12 and 13 August 2005, 15 July 2006), and fledged juveniles (12 and 13 August 2005) were observed.

Egg-laying at the artificial cay in 2005, accounting for a maximum incubation period of 24 days (Schreiber and Burger 2002), occurred no earlier than 20 July. This was relatively late for the Caribbean region (Gochfeld *et al.* 1998) and suggests the possibility of failed nesting and abandonment of another site earlier in the season.

Findings confirm the continuing presence of a Roseate Tern colony at the Utila Cays and document new colonies at Cayos Cochinos and the Barbareta Cays. These colonies totaled minimum adult populations in the Bay Islands of 288 and 184 individuals in

2005 and 2006, respectively. The only other extant colony known from Central America is at Tobacco Caye, Belize (Jones 2003), the present status of which is uncertain (H. L. Jones, pers. comm.).

On the Utila Cays, Roseate Terns were known historically from Sandy Cay, where 13 nests were recorded between 19 June and 8 August 1971 (Udvardy *et al.* 1973). A tern colony on Sandy Cay was present annually through 2004 (confirmed by two local sources) after which time it has not been occupied.

Although the presence of nesting Roseate Terns at Cayos Cochinos was documented for the first time in this effort, this species has likely been present historically. In addition to Udvardy *et al.*'s (1973) report of "small terns" in the Cayos Cochinos mentioned previously, Seutin *et al.* (1997) tentatively identified as Roseate Terns six small *Sterna* terns in Cayos Cochinos in May 1995.

Supplementary observations establish extreme dates of occurrence of Roseate Terns in the Bay Islands from late May to mid September. None were present at Cayos Cochinos on 11 May 2006 (D. Shoch, pers. obs.) and the latest date Roseate Tern has been observed in the Bay Islands is on 10 September 2005 at Cayos Cochinos (D. Shoch, pers. obs.).

Royal Tern

Royal Terns, primarily adults, were observed loafing individually or in groups of up to 15 birds at cays in the Cayos Cochinos, Guanaja Cays, and Barbareta Cays (Table 2). No evidence of local breeding was detected in the 2005 and 2006 surveys. This species has been previously documented nesting in the Bay Islands at Cayo Gallo, Cayos Cochinos, in 1994 and 1995 (Seutin *et al.* 1997). Prior to this, Monroe (1968) reported anecdotal evidence for an apparent colony of Royal Tern on "Fowl Key [Cayo Gallo]", Cayos Cochinos.

Sandwich Tern

Sandwich Terns were observed only in the Barbareta Cays and Cayos Cochinos, in groups of eleven to 24 individuals (Table 2).

Three juveniles in plumage indicative of recent fledging (yellow bill edges, crisp dark markings on scapulars and tertials; Malling Olsen and Larsson 1995) were observed on 15 July 2006 with 20 adults at Busher Mahegony, Barbareta, where 22 adult and two juvenile Sandwich Terns were recorded the previous year on 27 August. Although juveniles may disperse widely from their natal sites after fledging, the 15 July 2006 observation suggests local breeding by this species, which may have fledged young shortly before the surveys. Although not known to breed in Honduras (Monroe 1968; Bonta and Anderson 2002), this species nests on cays off Belize (Howell and Webb 1995; Jones 2003).

DISCUSSION

Our findings serve to document the status of tern colonies active during the 2005 and 2006 breeding seasons in the Bay Islands. Counts from single date surveys such as these are not intended as estimates of total breeding population present seasonally, but where repeated during the same stage of breeding phenology serve as an index of annual colony occupancy that can be obtained with limited field effort.

Two factors complicate the interpretation of single survey counts. First, direct counts of adults do not distinguish between breeders and non-breeders and may thus overestimate the population of breeding adults. Second, given the degree of breeding asynchrony witnessed among Roseate and Least Terns, single survey counts may underestimate the total population present seasonally. For example, recently fledged juveniles, downy young and incubating adults of Roseate Tern were all observed on 13 August 2005 at the artificial cay site at Utila, suggesting egg-laying staggered over >22 days (minimum fledging period; Schreiber and Burger 2002). Similarly, Udvardy *et al.* (1973) recorded Roseate Tern eggs from 19 June to 8 August. For these reasons, counts are presented strictly as minimum adult population present seasonally.

Despite the apparent staggered nature of egg-laying noted above, the 2005 and 2006

surveys took place at or following the seasonal peak of egg-laying. Urdvady *et al.* (1973) recorded apparent peak egg:chick ratios at Sandy Cay, Utila, on 29 June 1971 of 11:3 and 41:2 for Roseate and Least terns respectively, comparable to the observation of 40 incubating adults and two downy young Roseate Terns on 15 July 2006 at Busher Mahegeny, Barbareta (this study). On the later date of 13 August 2005 at the artificial cay Utila, lower egg:chick ratios were estimated of 31:22 and 9:4 for Roseate and Least terns respectively.

Both Roseate and Least tern colonies displayed high annual turnover rates over the two seasons investigated. No Roseate Tern colonies and only one of six Least Tern colonies were occupied in both the 2005 and 2006 surveys. The annual colony turnover rate calculated here for Least Tern (0.71) is probably inflated; the period from egg-laying to fledging may be as little as 36 days (Schreiber and Burger 2002), and it is possible that successful colonies were missed with single surveys. Even so, had Least Terns nested earlier in the 2005 season in Cayos Cochinos or the Guanaja Cays, at least some incidental observations of lingering adults or fledged juveniles should have been recorded in the area at the time of the surveys; no individuals of this species were observed in either island group in mid August 2005.

The ephemeral nature of these islets may explain in part the high annual turnover rates apparent among Roseate and Least Tern colonies. The size and configuration of islets can change dramatically following a single storm event via erosion or deposition. Several examples suggest colony abandonment as a response to diminution of islet area: (1) two anecdotal accounts independently confirmed that terns ceased to nest on Sandy Cay after 2004, where they had nested annually until then, and that this coincided with a significant reduction in the size of the sandy point on the southeast side of the cay; (2) Elmar Reef off Guanaja supported a colony of terns prior to Hurricane Mitch in 1998, after which the former islet was reduced to a coral breakwater with limited area above the high water mark; and (3) Cayo Arena, which hosted a large colony of Rose-

ate Terns in 2005, was appreciably smaller in 2006 when no colony was in evidence.

Inconsistent occupation of colony sites may also result from the vagaries of disturbance by foot traffic and egg collectors. Tourism is increasing in the Bay Islands, resulting in almost daily foot traffic by visitors that may explain the absence of terns at historic nest sites at Cayo Timón and beaches on the main islands of Utila and Barbareta. Many cays have houses used seasonally by the owners and often rented to tourists. On Sandy Cay, Utila, the presence of renters and dogs may have been a contributing factor in driving nesting terns from this historic colony site. Restricting tourism visitation at cays with active colonies during the nesting season may prove necessary for the long-term viability of tern nesting in the Bay Islands.

Urdvady *et al.* (1973) noted the annual collection of eggs at the tern colony on Sandy Cay, Utila, by local residents. Presently terns continue to be referred to as "egg birds", despite assurances by local residents that this practice no longer occurs there. However, fishermen at Barbareta and cays off Moskitia confirmed that eggs continue to be taken from tern colonies there. Orwil James (pers. comm.) reported that 120 tern eggs were taken from Falls Mahegeny, Barbareta, in 2005 in a single day.

Although the marine areas encompassing cays in the Bay Islands harboring active or historic nesting colonies of terns have some nascent status as protected areas, few have received legal designation, and the cays themselves are all under private ownership (Shoch and Canfield 2006). Tern colony sites at the Cayos Cochinos (Cayo Arena, Cayo Zacate and Cayo Gallo), although privately owned, are managed by a non-governmental conservation organization (HCRF) in conformance with standards set out in the Monumento Natural Marino del Archipiélago de Cayos Cochinos management plan and legislative decree. Similarly, Raggedy Cay has been afforded protection through a formal conservation agreement between its owner and the Utila municipality. These experiences serve as successful examples of conservation on private lands that should be replicated at other

important sites in the Bay Islands. Of course, securing protected status for only those cays hosting active colonies is not a viable long-term conservation strategy. Potential nesting habitat to accommodate future colonies, such as suitable cays currently unoccupied, and marine banks or shoals, requires further identification and protection, as well as conservation and management of the marine resources on which these colonies depend.

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